PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 12231PCT dl:df	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. **PCT/AU2004/001276**	International filing date *(day/month/year)* 20 September 2004	Priority date *(day/month/year)* 19 September 2003

International Patent Classification (IPC) or national classification and IPC

Int. Cl. [7] A01B 49/06, 7/00, 15/16, 15/18, 35/28; A01C 5/06, 5/08, 7/06

Applicant

GREGOR, David

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. [X] *(sent to the applicant and to the International Bureau)* a total of **8** sheets, as follows:
      [X] sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      [ ] sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. [ ] *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:

[X]	Box No. I	Basis of the report
[ ]	Box No. II	Priority
[ ]	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
[X]	Box No. IV	Lack of unity of invention
[X]	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
[ ]	Box No. VI	Certain documents cited
[ ]	Box No. VII	Certain defects in the international application
[ ]	Box No. VIII	Certain observations on the international application

Date of submission of the demand 14 July 2005	Date of completion of the report 6 September 2005
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer **L. DESECAR** Telephone No. (02) 6283 2381

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY	International application No. PCT/AU2004/001276

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:

   ☐ international search (under Rules 12.3 and 23.1 (b))

   ☐ publication of the international application (under Rule 12.4)

   ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

   ☐ the international application as originally filed/furnished

   ☒ the description:

   pages **1, 6-15** as originally filed/furnished
   pages* **2-5** received by this Authority on **14 July 2005** with the letter of **12 July 2005**
   pages* received by this Authority on with the letter of

   ☒ the claims:

   pages as originally filed/furnished
   pages* as amended (together with any statement) under Article 19
   pages* **16-19** received by this Authority on **14 July 2005** with the letter of **12 July 2005**
   pages* received by this Authority on with the letter of

   ☒ the drawings:

   pages **1/12-12/12** as originally filed/furnished
   pages* received by this Authority on with the letter of
   pages* received by this Authority on with the letter of

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

   ☐ the description, pages
   ☐ the claims, Nos.
   ☐ the drawings, sheets/figs
   ☐ the sequence listing (*specify*):
   ☐ any table(s) related to the sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

   ☐ the description, pages
   ☐ the claims, Nos.
   ☐ the drawings, sheets/figs
   ☐ the sequence listing (*specify*):
   ☐ any table(s) related to the sequence listing (*specify*):

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY	International application No. PCT/AU2004/001276

Box No. IV Lack of unity of invention

1. ☐ In response to the invitation to restrict or pay additional fees the applicant has:

   ☐ restricted the claims.

   ☐ paid additional fees.

   ☐ paid additional fees under protest.

   ☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is:

   ☐ complied with.

   ☒ not complied with for the following reasons:

   See supplemental Box.

4. Consequently, this report has been established in respect of the following parts of the international application:

   ☒ all parts.

   ☐ the parts relating to claims Nos.

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-21	YES
	Claims	NO
Inventive step (IS)	Claims 1-21	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-21	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

Claims 1-21 meet the criteria set out in the PCT Article 3(2)-(4), because none of the prior art documents teaches or fairly suggests an apparatus for furrow opening in soil including a first disc, configured to rotate around a first axis of rotation, having a blade with an outer perimeter that includes a plurality of symmetrical teeth, a second analogous disc, configured to rotate around a second axis of rotation, operatively coupled to the first disc, wherein the first and second discs are configured to incise and progressively widen a furrow in the soil thereby minimising soil disturbance.

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: Box IV. 3.

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are different inventions as follows:

1. Claims 1 and 16-19 are respectively directed to an apparatus for furrow opening in soil including the features as defined, and a method for creating a seed furrow in soil using a furrow opener involving the features as defined. It is considered that *first and second discs are configured to progressively widen a furrow and that the second disc is operatively coupled to the first disc* comprises a first special technical feature.

2. Claims 2-8 are directed to an apparatus for furrow opening in soil including the features as defined. It is considered that *teeth of the first and second discs are in closer proximity at the leading edge than at the trailing edge and where the second disc is operatively coupled to the first disc* comprises a second special technical feature.

3. Claims 9-15 directed to an apparatus for furrow opening in soil including the features as defined. It is considered that *a seeding implement having a seeding wheel including a plurality of teeth, at least one depth determining apparatus* comprises a third special technical feature.

Independent Claims 1, 16 and Claim 2 share the common features, therefore unity exists between these claims.

Independent Claims 1-2, 16 and claim 9 share the common features of an apparatus for furrow opening in soil including a first and second discs, however these features are well known from the prior art document for example US 4275671 A (BAKER) 30 June 1981, consequently the common features are not a special technical feature within the definition of the PCT rule 13.2 since they do not together make a contribution over the prior art. Therefore the inventions as defined in the above groups of claims lack unity a posteriori.

soil, since the discs form a longitudinally extending wedge at the point of entry into the soil.

Another limitation with the conventional double disc opener is that during operation straw is often pushed into the seed furrow. This is known as hair pinning and can result in the subsequently sown crop being affected by phytotoxins. Phytotoxins are compounds produced through the process of plant decomposition which can inhibit the growth of other plants. Hair pinning can also result in incomplete furrow closure that may further decrease the fecundity of the crop.

Yet another disadvantage with conventional double disc openers is the placement of fertilizer in close proximity to seed. A lack of separation between the seed and fertiliser can result in concentrations of fertiliser that are toxic to the germinating seed.

The potential of straw and plant material blocking the apparatus is also a significant problem in the operation of conventional furrow openers. A blockage can prevent the production of a viable furrow. Furthermore, a blockage increases the power required to pull the disc apparatus through the soil. This causes considerable inconvenience to the user and can increase operational costs.

It is an object of the present invention to provide an apparatus and method for furrow opening using a furrow opener that overcomes at least some of the aforementioned problems or provides the public with a useful alternative.

It is yet a further object of the present invention to provide for a furrow opener that reduces the likelihood of hair pinning and other problems associated with conventional furrow opening apparatus.

SUMMARY OF THE INVENTION

Therefore in one form of the invention there is proposed an apparatus for furrow opening in soil including:

a first disc, configured to rotate around a first axis of rotation, having a blade with an outer perimeter that includes a plurality of symmetrical teeth;

a second analogous disc, configured to rotate around a second axis of rotation, operatively coupled to said first disc;

wherein said first and second discs are configured to incise and progressively widen a furrow in said soil thereby minimising soil disturbance.

In a further form of the invention there is proposed an apparatus for furrow opening in soil including:

a first disc configured to rotate around a first axis of rotation, said first disc includes a blade outwardly extending from said first axis of rotation, wherein said blade has an outer perimeter which includes a plurality of analogous outwardly extending teeth;

a second analogous disc operatively coupled to said first disc and configured to rotate around a second axis of rotation, said second disc mirrors said first disc along a central line of symmetry which is substantially parallel to the direction in which said apparatus travels when a furrow is being created;

said apparatus includes a leading edge and a trailing edge, wherein said teeth of said first and second discs are in closer proximity at said leading edge than at said trailing edge.

Preferably, said axes of rotation of said first and second discs are substantially perpendicular to the direction of travel of said apparatus.

Preferably, said first and second disc discs are mounted so as to upwardly and rearwardly diverge from each other.

Preferably, said teeth on the perimeter of the first disc abut the teeth on the perimeter of the second disc at a lower vertical position approximating the soil entry point.

Preferably, a scraping assembly is associated with the opening disc apparatus to dislodge any soil or straw that adheres to the said first and second discs during operation.

Preferably, said first and second discs are configured to rotate in unison wherein said teeth on said first disc aligns with said teeth on said second disc.

Preferably, said first disc moves independently from said second disc.

In yet a further form of the invention there is proposed an apparatus for furrow opening in soil including:

a fertiliser furrow opener adapted to create a fertiliser furrow, said fertiliser furrow

opener having a first and second disc that include a plurality of teeth, wherein said discs are configured to incise and progressively widen a furrow in said soil thereby minimising soil disturbance, said apparatus includes a leading edge and a trailing edge, wherein said teeth of said first and second discs are in closer proximity at said leading edge than at said trailing edge;

at least one fertiliser outlet adapted to dispense fertiliser;

a seeding implement having a seeding wheel with an outer circumference that includes a plurality of teeth adapted to create a seeding furrow;

at least one seed outlet adapted to dispense seed; and

at least one depth determining apparatus adapted to govern the depth of said fertiliser furrow and said seeding furrow.

Preferably, said apparatus for furrow opening includes a gear mechanism configured to mechanically couple between said seeding implement and said fertiliser furrow opener.

Preferably, said teeth of said first and second discs are analogous.

Preferably, said teeth of said seeding wheel are analogous.

Preferably, said fertiliser outlet is adapted to dispense fertiliser into said furrow created by said fertiliser furrow opener.

Preferably, said seeding wheel is adapted to partially fill the furrow created by said fertiliser furrow opener and then create said seeding furrow into which seed, dispensed from said seed outlet, is deposited.

Preferably, said apparatus includes at least one press wheel adapted to cover said seed with soil.

In still a further form of the invention there is proposed a method for creating a seed furrow in soil using a furrow opener having a first and second disc that include a plurality of teeth, said method includes the steps of:

moving said furrow opener across the surface of said soil, whereby said furrow opener incises the surface of said soil; and

allowing said first and second discs to rotate about axes of rotation that are substantially perpendicular to the direction of travel of said furrow opener, said furrow

opener includes a leading edge and a trailing edge, wherein said teeth of said first and second discs are in closer proximity at said leading edge than at said trailing edge, whereby said first and second discs are configured to progressively widen said furrow as said furrow opener is moved over the surface of said soil.

Preferably, more than one pair of said discs is attached to an agricultural implement.

Preferably, the depth to which said discs penetrate said soil can be adjusted.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this specification together with the description, serve to explain the advantages and principles of the invention. In the drawings,

Figure 1 is a perspective view of a furrow opening assembly embodying the present invention;

Figure 2 is a side view of furrow opening assembly of Figure 1;

Figure 3 is a perspective view of the discs and depth wheel of Figure 1;

Figure 4 is a side view of the discs and depth wheel of Figure 1 illustrating the relative positions of the teeth on the discs;

Figure 5 is a perspective view of the furrows that are created by the furrow opening assembly of Figure 1 illustrating the depositing of fertiliser or seeds into the furrow;

Figure 6 is a perspective view of a second embodiment of the furrow opener of the present invention illustrating the attachment of a seeding arm;

Figure 7 is a side view of the furrow opener of Figure 6 illustrating the depositing of seed and fertiliser into the furrow;

Figure 8 is a top view of the furrow opener of Figure 6;

Figure 9 is a perspective view of the seeding wheel of Figure 6 as it enters the furrow created by the furrow opener;

Figure 10 is a perspective view of the furrow opener of Figure 6 illustrating the attachment of a grader type blade;

CLAIMS

1. An apparatus for furrow opening in soil including:
a first disc, configured to rotate around a first axis of rotation, having a blade with an outer perimeter that includes a plurality of symmetrical teeth;
a second analogous disc, configured to rotate around a second axis of rotation, operatively coupled to said first disc;
wherein said first and second discs are configured to incise and progressively widen a furrow in said soil thereby minimising soil disturbance.

2. An apparatus for furrow opening in soil including:
a first disc configured to rotate around a first axis of rotation, said first disc includes a blade outwardly extending from said first axis of rotation, wherein said blade has an outer perimeter which includes a plurality of analogous outwardly extending teeth;
a second analogous disc operatively coupled to said first disc and configured to rotate around a second axis of rotation, said second disc mirrors said first disc along a central line of symmetry which is substantially parallel to the direction in which said apparatus travels when a furrow is being created;
said apparatus includes a leading edge and a trailing edge, wherein said teeth of said first and second discs are in closer proximity at said leading edge than at said trailing edge.

3. An apparatus for furrow opening in soil as in any of the above claims wherein said axes of rotation of said first and second discs are substantially perpendicular to the direction of travel of said apparatus.

4. An apparatus for furrow opening in soil as in any of the above claims wherein said first and second disc discs are mounted so as to upwardly and rearwardly diverge from each other.

5. An apparatus for furrow opening in soil as in any of the above claims wherein said teeth on the perimeter of the first disc abut the teeth on the

perimeter of the second disc at a lower vertical position approximating the soil entry point.

6. An apparatus for furrow opening in soil as in any of the above claims wherein a scraping assembly is associated with the opening disc apparatus to dislodge any soil or straw that adheres to the said first and second discs during operation.

7. An apparatus for furrow opening in soil as in any of the above claims wherein said first and second discs are configured to rotate in unison wherein said teeth on said first disc aligns with said teeth on said second disc.

8. An apparatus for furrow opening in soil as in any of the above claims wherein said first disc moves independently from said second disc.

9. An apparatus for furrow opening in soil including:
a fertiliser furrow opener adapted to create a fertiliser furrow, said fertiliser furrow opener having a first and second disc that include a plurality of teeth, wherein said discs are configured to incise and progressively widen a furrow in said soil thereby minimising soil disturbance, said apparatus includes a leading edge and a trailing edge, wherein said teeth of said first and second discs are in closer proximity at said leading edge than at said trailing edge;
at least one fertiliser outlet adapted to dispense fertiliser;
a seeding implement having a seeding wheel with an outer circumference that includes a plurality of teeth adapted to create a seeding furrow;
at least one seed outlet adapted to dispense seed; and
at least one depth determining apparatus adapted to govern the depth of said fertiliser furrow and said seeding furrow..

10. An apparatus for furrow opening in soil as in claim 9 wherein said apparatus for furrow opening includes a gear mechanism configured to mechanically couple between said seeding implement and said fertiliser furrow opener.

11. An apparatus for furrow opening in soil as in claim 9 wherein said teeth of said first and second discs are analogous.

12. An apparatus for furrow opening in soil as in claim 9 wherein said teeth of said seeding wheel are analogous.

13. An apparatus for furrow opening in soil as in claim 9 wherein said fertiliser outlet is adapted to dispense fertiliser into said furrow created by said fertiliser furrow opener.

14. An apparatus for furrow opening in soil as in claim 9 wherein said seeding wheel is adapted to partially fill the furrow created by said fertiliser furrow opener and then create said seeding furrow into which seed, dispensed from said seed outlet, is deposited.

15. An apparatus for furrow opening in soil as in claim 9 wherein said apparatus includes at least one press wheel adapted to cover said seed with soil.

16. A method for creating a seed furrow in soil using a furrow opener having a first and second disc that include a plurality of teeth, said method includes the steps of:
moving said furrow opener across the surface of said soil, whereby said furrow opener incises the surface of said soil; and
allowing said first and second discs to rotate about axes of rotation that are substantially perpendicular to the direction of travel of said furrow opener, said furrow opener includes a leading edge and a trailing edge, wherein said teeth of said first and second discs are in closer proximity at said leading edge than at said trailing edge, whereby said first and second discs are configured to progressively widen said furrow as said furrow opener is moved over the surface of said soil.

17. A method for creating a seed furrow in soil as in claim 16 wherein more than one pair of said discs is attached to an agricultural implement.

18. A method for creating a seed furrow in soil as in claim 16 wherein the depth to which said discs penetrate said soil can be adjusted.

19. An apparatus for furrow opening in soil substantially as herein before described with reference to Figures 1-5.

20. An apparatus for furrow opening in soil substantially as herein before described with reference to Figures 6-10.

21. An apparatus for furrow opening in soil substantially as herein before described with reference to Figures 11-12b.